MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

TDP3471 – DISTRIBUTED AND PARALLEL COMPUTING
(All Sections / Groups)

5 MARCH 2018
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages (including cover page) with 5 Questions only.

1. Attempt **ALL** questions. The distribution of the marks for each question is given. This paper carries **50 marks**.

2. Please print all your answers in the Answer Booklet provided in this examination.

Question 1 (10 marks)

a) State the primary motivation for Distributed Systems.

[1 mark]

b) Achieving "transparency" is one of the major challenge of a Distributed System. State and explain briefly 4 different types of "transparency".

[6 marks]

c) Briefly explain the differences between UDP Datagram Communication and TCP Stream Communication.

[3 marks]

Question 2 (10 marks)

a) Explain the statement "A distributed system has no notion of a global clock", using distributed communicating programs in your explanation.

[2 marks]

b) In the implementation of Remote Procedure Calls (RPC), an Interface Definition Language (IDL) is required. Explain the concept of IDL.

[2 marks]

c) Briefly explain the similarities between Remote Method Invocation (RMI) and Remote Procedure Calls (RPC).

[2 marks]

d) Remote Procedure Call (RPC) mechanisms cannot handle pointers (pointer means a reference to a location in memory). What problem will this create and how can it be addressed?

[2 marks]

e) In the concept of Exchange Protocols, there are 3 methods as tabled below. Using the RRA method, the server has the option to remove the entries from its history. Briefly explain why the server should keep the entries in its history for the other two methods, R and RR?

Name	Messages sent by		
	Client	Server	Client
R	Request		
RR	Request	Reply	
RRA	Request	Reply	Acknowledge reply

[2 marks]

Continued ...

Question 3 (10 marks)

a) Based on your understanding, describe the function of a network socket.

[2 marks]

b) What are the 4 basic steps for socket programming on the TCP Client side? Draw the communication diagram between the TCP Client and the TCP Server.

[6 marks]

c) Briefly discuss at least two (2) differences between the Clustered Computing and Distributed Processing.

[2 marks]

Question 4 (10 marks)

a) Assuming that you have a program called `newprog.c` which uses the pthread library and you want to compile it into an executable called `myprog`, what is the command used in Linux?

[3 marks]

b) A critical section requires a mechanism for ensuring that only one process accesses a particular resource at a time. Explain one such mechanism to achieve this when two or more processes are attempting to access the same shared resource.

[3 marks]

c) What is superlinear speedup?

[1 mark]

d) Bernstein's conditions are a set of conditions that are sufficient to determine whether two processes can be executed simultaneously (deadlock free). We define two sets of memory locations:

- I_i is the set of memory locations read by process P_i.
- O_j is the set of memory locations altered by process P_j.

Using these set of memory locations I_i and O_j, state the 3 Bernstein's conditions.

[3 marks]

Question 5 (10 marks)

a) Name the functions that have to be executed
    a. before any other MPI functions can be used (the first MPI function), and
    b. the last MPI function that has to be executed.

[2 marks]

b) Suppose that MPI COMM WORLD consists of the three processes 0,1, and 2, and the following code is executed:

```
int x, y, z;
switch(my_rank) {
   case 0:
      x=0; y=1; z=2;
      MPI_Bcast(&x, 1, MPI_INT, 0, MPI_COMM_WORLD);
      MPI_Send(&y, 1, MPI_INT, 2, 43, MPI_COMM_WORLD);
      MPI_Bcast(&z, 1, MPI_INT, 1, MPI_COMM_WORLD);
      break;
   case 1:
      x=3; y=8; z=5;
      MPI_Bcast(&x, 1, MPI_INT, 0, MPI_COMM_WORLD);
      MPI_Bcast(&y, 1, MPI_INT, 1, MPI_COMM_WORLD);
      break;
   case 2:
      x=6; y=7; z=8;
      MPI_Bcast(&z, 1, MPI_INT, 0, MPI_COMM_WORLD);
      MPI_Recv(&x,  1,  MPI_INT,  0,  43,  MPI_COMM_WORLD,
&status);
      MPI_Bcast(&y, 1, MPI_INT, 1, MPI_COMM_WORLD);
      break;
}
```

Synopses of the MPI functions are as given below (for reference on the parameters):

```
int MPI_Bcast( void *buffer, int count, MPI_Datatype datatype,
               int root, MPI_Comm comm )

int MPI_Send(const void *buf, int count, MPI_Datatype datatype,
               int dest, int tag, MPI_Comm comm)

int MPI_Recv(void *buf, int count, MPI_Datatype datatype, int source,
               int tag, MPI_Comm comm, MPI_Status *status)
```

What are the values of x, y, and z on each process after the code has been executed?

[6 marks]

c) Explain the differences between blocking and non-blocking message passing.

[2 marks]

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